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VASCULAR PLANTS ON A SPRUCE BALD IN COLORADO

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At Boreas Pass, just below tree-line on the Continental Divide, Summit County, Colorado (39° 25′ N, 105° 58′ W; 3,609–3,657 m elevation), there is a 90-year-old spruce bald. This bald was formed primarily by clear cutting practices carried out by the Denver, South Park, and Pacific Railroad in its construction of a line over Boreas Pass in 1882 (*Montezuma Millrun,* 1882). Fire has been a secondary influence in forming the bald (Ubbelohde, 1965; E. J. Haley, pers. comm., 1972).

The summit of the pass and the slopes approaching the summit comprise the bald. The area as a whole provides a mosaic configuration of unaltered sites, severely altered sites, and sites of intermediate disturbance among which comparisons of environmental changes may be made. A study of these differences indicates that the major factor controlling vegetation is substrate instability (Olgeirson, 1972). This feature has also been described as a determining factor in arctic vegetation (Raup, 1951; Sigafoos, 1952).

Maintenance of the bald is due to the unfavorable influence of a drastically altered environment on tree reëstablishment (Stahelin, 1943; Billings and Mark, 1957; Billings, 1969; Olgeirson, 1972). Environmental changes have also created a marked reorientation in herbaceous plant communities. Functionally, this change is regressional, marked by a trend toward vegetation having a physiognomy like alpine fell-fields; floristically, there is a trend toward increased frequency of vascular plants usually associated with the alpine tundra (Billings, 1957, 1969; Weber and Willard, 1967).

Contrasted to this trend are vegetation sites that are unaltered or intermediate. Intermediate sites have been cut-over, usually to a lesser degree than disturbed sites, and operate under environmental conditions that are less inclement. Vegetation shows a mixture of alpine and subalpine physiognomies and flora.

The stable sites are those where no cutting was done. The vegetation dynamics and the flora of these meadows is subalpine in character. The stable sites are floristically diverse; vegetation forms a dense surface cover; soils are deep and relatively fertile; and there is little directional response to physical processes such as wind and snow blast, snow blow-out, run-off, and soil-frost activity. Disturbed sites are floristically poor in comparison; individual taxa have low densities; surface plant cover is very sparse; soils are low in organic carbon—buried soils are the rule due to heavy erosion of surface materials; and there is a strong directional and regressional trend caused by the effects of wind (and associated particles) stress to the surface and vegetation, extreme diurnal temperature variations, snow blow-out, and congelturbation. Intermediate sites have a mixture of the above characteristics (with the exception of frequent pocket gopher activity), although individual sites may be more or less like stable or disturbed sites.

Development of fell-field characteristics by sites on the bald is a response to disturbance. Disturbance has set up process features that parallel those of alpine fell-field situations. The most outstanding floristic changes between disturbed sites and undisturbed sites are in morphology and life form. There is an increase in taxa expressing characteristics that are associated with alpine plants, such as extensive root development and caespitose habit. Conversely, there is a decrease in taxa that are rhizomatous. Life form differences for disturbed and undisturbed sites generally correspond to the differences between alpine and subalpine vegetation (Daubenmire, 1968); there is a predominance of hemicryptophytes and chamaeophytes on disturbed sites and a low frequenecy of phanerophytes, geophytes, and thermophytes on these sites. Conversely, there are higher frequencies of geophytes, phanerophytes, and thermophytes on undisturbed sites and lower frequencies of chamaeophytes and hemicryptophytes on these sites (Braun-Blanquet, 1972).

The dominant influences of soil instability on the vegetation of disturbed and intermediate sites are: (1) the maintennace of grasses, especially bunchgrasses *(Festuca ovina, Trisetum spicatum, Stipa columbiana, Agropyron trachycaulum, Poa interior, P. fendleriana,* and *Deschampsia caespitosa)* and tussock forming sedges (*Carex chalciolepis* and *C. epapillosa)*; (2) the increased occurrence of weedy and ubiquitous forbs *(Achillea lanulosa, Chrysopsis villosa, Senecio werneriaefolius, Antennaria parvifolia, Cirsium parryi, Taraxacum officinale, Tragopogon pratensis, Penstemon whippleanus, Chenopodium leptophyllum, Arabis drummondii,* and *Phacelia sericea)*; and (3) the introduction of plants

more strictly associated with the alpine tundra or of plants having morphological characteristics common to alpine plants (*Geum rossii, G. triflorum, Bistorta bistortoides, B. viviparum, Sibbaldia procumbens, Oreoxis alpina, Eritrichium aretioides, Mertensia alpina, Androsace septentrionalis, Oxytropis parryi, Delphinium alpestre, Sedum lanceolatum, Lewisia pygmaea, Draba exunguiculata, Polemonium viscosum, Minuartia macrantha, M. obtusiloba, Townsendia rothrockii, Artemisia pattersonii, A. scopulorum, Erysimum nivale, Erigeron simplex, Luzula spicata, Lloydia serotina, Ranunculus adoneus, Saxifraga serpyllifolia, Pedicularis parryi,* and *Chaenactis alpina* var. *leucopsis,* as well as the grasses and other taxa included above). Intermediate soil instability is also reflected by the occurrence of putative hybrids, such as *Potentilla concinna* (W. Weber, pers. comm., 1972).

Contrasted to the predominance of the above taxa, and the morphologies that they represent, is the decreased frequency of rhizomatous taxa such as *Carex foenea* and *Juncus drummondii,* and the absence of other taxa previously associated with *Carex foenea* sods (*Veronica wormskjoldii, Erigeron speciosus,* and *E. glabellus*) and with moist subalpine meadows (*Trifolium parryi, Arnica cordifolia, Antennaria anaphaloides, Thlaspi alpestre, Gentiana calycosa, Carex hoodii, C. nelsonii, Potentilla diversifolia, Fragaria vesca* ssp. *americana, Poa alpina, Ranunculus inamoenus, Castilleja sulphurea, Anemone narcissiflora* ssp. *zephyra, Agrostis thurberiana, Astragalus alpinus, Campanula parryi, Oxytropis lambertii, Senecio crocatus, Mertensia bakeri, Gentianopsis thermalis, Swertia perennis, Allium rubrum, Penstemon procerus, Valeriana capitata,* and *Erigeron subtrinervis*).

The physiognomy and flora of the disturbed sites at Boreas Pass reinforces the idea that the difference in adaptive abilities in alpine and subalpine vascular plants is a measure of specific tolerances. The one tolerance most applicable here is that of cyclic phenomena of a harsh or disruptive nature, such as soil instability.

The following sources were used in the identification of plants: Hitchcock (1950); Harrington (1954); Taylor (1959); Murray (1969); Weber (1972); and Á. Löve, pers. comm. (1972). A checklist of all species found at Boreas Pass, indicating their occurrence on disturbed, intermediate, or undisturbed sites, is available from the author on request. Vouchers are in the herbarium of the University of Colorado, Boulder (COLO). My thanks go to Áskell Löve for his help in identifying certain taxa and to Miriam Colson for her aid in identifying sedges.

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NEW OR INTERESTING SPECIES OF CLAUDOPUS AND ENTOLOMA FROM THE PACIFIC COAST

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A survey of the rhodophylloid fungi sensu Largent and Benedict (1971) found on the Pacific Coast of the United States has been underway since late 1960. Type specimens of those species described as new from this area have been studied and a report published (Largent, 1971). A list of species previously reported from California, Washington, and Oregon, as well as descriptions of various taxa of *Nolanea,* were published in 1972 (Largent and Thiers, 1972). Additionally a study of *Alboleptonia* was completed and included several species from the Pacific Coast (Largent and Benedict, 1970).

The following account describes my studies of *Claudopus byssisedus* and is the first report of this species from Washington and California. Also included in this report are the following: the first report of *Entoloma madidum* from Washington; a description of a previously undescribed form, *E. madidum* var. *madidum* f. *farinosum;* the creation of a